

Riparian Management Strategies

Riparian Management Zones and the Riparian Conservation Strategy

DNR's trust land Habitat Conservation Plan riparian management strategy consists of several parts (DNR 1997 IV.56). The prominent feature is the designation of Riparian Management Zones (RMZs) on specific stream types. The stream typing methodology described below will be followed when carrying out forest management activities in RMZs on HCP lands within the five Westside HCP planning units. All streams will be field verified (typed) before planning any restoration activities.

Typing of Streams

DNR and the Federal Services (U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration Fisheries) have agreed the Washington Forest Practices Board Emergency Rules (stream typing), November 1996 (WAC 222-16-030) meet the intent of DNR's trust lands HCP. This stream typing system will now be officially referenced as the "Water Typing System for Forested State Trust HCP Lands." In the future, DNR may modify its stream typing strategy as new information becomes available. Any eventual changes to the stream typing methodology would be subject to review and concurrence by the Federal Services.

DNR will implement all aspects of its riparian conservation strategy as well as other strategies that require stream typing using this water typing system. See Appendix 3 for the full text. The following is a summary of the pertinent details of the typing system. Use them as guidance for field methods such as stream width determinations.

- Type 1.** Streams inventoried and classified as "Shorelines of the State."
- Type 2.** Streams that are known to be used, or have been identified being used, by resident or anadromous fish species.
- Type 3.** Stream segments having a defined channel (with scour) of an average of 2 feet or greater in width between the ordinary high-water marks; and having a gradient of 16 percent or less; or
Stream segments having a defined channel (with scour) of an average of 2 feet or greater in width between the ordinary high-water marks; and having a gradient greater than 16 percent and less than 20 percent; and having greater than 50 acres in contributing basin size, based on hydrographic boundaries.

Type 1-3 streams are to be considered as fish bearing, and are assumed to be used by a significant number of resident and/or anadromous fish species.

These stream-typing characteristics may be modified on a site-by-site basis under the following circumstances:

- (a) Waters have confirmed, long term, naturally occurring water quality parameters incapable of supporting anadromous or resident fish;
- (b) Snowmelt streams have short flow cycles that do not support successful life history phases of anadromous or resident fish. These streams typically have no flow in the winter months and discontinue flow by June 1; or
- (c) Sufficient information about a geographic region is available to support a departure from the characteristics listed above, as determined in consultation with the Department of Fish and Wildlife, Department of Ecology, the affected Tribes and other interested parties.

Type 4 Stream segments are non-fish-bearing and have a defined channel (with scour) of 2 feet or greater in width between the ordinary high-water marks; and having a gradient of 20 percent or greater.

Stream segments having a defined channel (with scour) of an average of 2 feet or greater in width between the ordinary high-water marks; and having a gradient greater than 16 percent and less than 20 percent; and having less than 50 acres in contributing basin size, based on hydrographic boundaries.

Type 5 Streams are significant stream segments that are less than 2 feet in width from the ordinary high-water marks and may be headwaters of streams, seeps or wet areas, or those stream segments that may go subsurface. Type 5 streams are to be considered as non-fish-bearing.

Application of Riparian Management Zones

When riparian ecosystems are encountered during forest management activities, the protection of the habitat of salmonids and riparian obligate species is of the highest priority. Riparian Management Zones will be left on Type 1, 2, 3, and 4 Waters; unstable slopes will be protected on all Type 1-5 Waters.

On Type 1-3 streams, DNR must maintain a proper RMZ width greater than or equal to the average height that an adjoining upland conifer stand would be expected to reach at age 100 years (breast height age) or 100 feet, whichever is greater, measured at a horizontal distance from the outer edge of the 100-year floodplain (see Determination of “Site Potential Tree Height” below). On any Type 4 stream, DNR must maintain an RMZ width of 100 feet or greater, measured at a horizontal distance from the outer edge of the 100-year floodplain.

All Type 5 Waters that flow through an area with high risk of mass wasting must be protected as per the unstable slope guidance. During the first ten years of the HCP, all other Type 5 streams (those not on areas associated with unstable slopes) must be protected “when necessary for water quality, fisheries habitat, stream banks, wildlife, and other important elements of the aquatic system” (DNR 1997 IV. 59 and 79).

Research to support the development of a long-term Type 5 stream conservation strategy is underway. By 2007, a long-term conservation strategy will have been developed for

Type 5 streams. In the interim, Type 5 streams should be afforded the following protection:

1. No equipment should pass across, within, or through these stream segments, where possible.
2. Trees should be directionally felled away from these stream segments.
3. Where operationally feasible, leave trees should be retained adjacent to these stream segments to provide protection of water quality, stream bank integrity, and wildlife habitat.

All of the RMZs are applied to both sides of the stream. Therefore, the total width of an RMZ may be two times the values listed in Table 3.

Additionally, wind buffers may apply. Wind buffers shall be applied to Type 1, 2, and 3 Waters in areas that are prone to windthrow. Wind buffers are applied in areas of moderate and high windthrow potential. Physical evidence of windthrow and windthrow models will guide the placement of wind buffers along Riparian Management Zones (DNR 1997 IV 59). To determine if wind buffers should be applied, foresters will rely on one or more of the following list of resources:

- Physical evidence of windthrow on or near the proposed restoration site
- Local knowledge and experience in this area in regards to windthrow potential
- Windthrow assessment guides such as the BC Ministry of Forestry Windthrow Handbook
- Consultation by region or division silviculturist

Table 3: Widths of buffers for one side of Riparian Management Zones.

Buffer Type	Buffer Width by Stream Type (shows one side of stream only)			
	1&2	3	4	5 ^b
Riparian	<i>“site potential^a tree height of mature conifer”</i> SI ₁₀₀ : avg. ~145 ft Minimum 100 ft Maximum 215 ft	<i>“site potential tree height of mature conifer”</i> SI ₁₀₀ : avg. ~145 ft Minimum 100 ft Maximum 215 ft	100 ft	<i>When necessary Guidelines pending</i>
Wind	<i>applied only in areas prone to windthrow:</i> 100 ft	<i>applied only to streams > 5 ft wide and only in areas prone to windthrow:</i> 50 ft	None	None
Total RMZ	Minimum 100 ft avg. ~145 ft Maximum 315 ft	Minimum 100 ft avg. ~145 ft Maximum 265 ft	100 ft	Unknown

^a Site potential height of mature conifer is defined as the height of the tallest 40 trees per acre at 100 years (SI₁₀₀)

^b DNR is conducting research to investigate adequate protection of Type 5 Waters.

DETERMINATION OF “SITE POTENTIAL TREE HEIGHT”

Riparian Management Zone width is indexed by “Site Potential Tree Height” of mature conifers for Type 1-3 Waters. The Interagency Science Committee (Cederholm et al. 1999) defined the “Site Potential Tree Height” as the base age 100-year site index for the dominant conifer species. DNR will rely on the Forest Land Grading Program when mapped site index is based on the soil series, or at the Department’s discretion, the Forest Resources Inventory System (FRIS) site index or measured site index to determine the “Site Potential Tree Height” using the SI_{50} at age 100.

Delineating Riparian Management Zones for Restoration

The state trust lands HCP specifies the subdivision of the riparian area into three zones and describes the functions of each zone (DNR 1997 IV. 59). Within the first 25 feet of a stream no harvest shall occur to primarily maintain stream bank stability. The next 75 feet of the RMZ are considered a “minimal harvest area” so that activities do not “appreciably reduce stream shading, the ability of the buffer to intercept sediment, or the capacity of the buffer to contribute detrital nutrients and large woody debris.” The remaining portion of the RMZ (more than 100 feet from the active channel margin) is considered a “low harvest” area. These three zones will be referred to as the inner (first 25 feet), middle (up to 100 feet), and outer zone on Type 1-3 Waters, and as the inner (first 25 feet) and outer zone (up to 100 feet) on Type 4 Waters.

The operational guidance described in this document combines the middle and outer zone for Type 1-3 Waters. By managing the middle and outer zone together, DNR is striking a balance to provide both efficient operations and assurance of ecological function. The silvicultural prescriptions of the Riparian Forest Restoration Strategy are designed to meet the objectives outlined in the HCP for the middle zone. Furthermore, if the zone beyond 100 feet from the stream had to be identified and managed separately, that added effort and cost would likely delay effective riparian restoration at most sites.

Maintaining Ecological Function

The most important recognized functions of riparian areas include large woody debris recruitment, leaf and needle litter recruitment, stream shade, microclimate, stream bank stability, and sediment control (Scientific Committee Recommendations, Cederholm et al. 1999, Final Environmental Impact Statement on Alternatives for the Forest Practices Rules for Aquatic and Riparian Resources, Washington State Forest Practices Board, 2001, Policy for Sustainable Forests Draft EIS 2005). DNR believes that the largest measure of riparian ecological function will be provided by unmanaged riparian vegetation and soils within the 25-foot inner zone, and where present, the 100-year floodplain. The extent and intensity of site disturbance resulting from prescribed riparian restoration utilizing thinning and biodiversity pathway techniques in the middle and outer zones beyond 25 feet would, in all instances, be minimal and provide a high likelihood of attaining the goals set for ecological functions. Chan et al (2004) reported that they “were unable to detect significant effects of either buffer width or upland density management on streambed water temperature, or air temperature and relative humidity within the first 15 feet of the stream center,” when conducting biodiversity pathway

thinnings in 40- to 60-year-old Douglas-fir riparian stands in western Oregon. When thinning to RD 35 or above, light levels were similar to those in unthinned stands, approximately 10 percent of light in the open. Newton et al. (1996; in Emmingham et al. 2000) also suggest that “thinning just outside a narrow no-cut buffer of 6–9 m (20–30 feet) would have minimal impact on stream shading (on the north side of streams).” Stream temperature is not influenced by direct solar radiation alone but by many factors such as latitude, altitude, season, channel width and depth, and groundwater flow (Forest Practices Board, Final EIS 2001). Cross (2002) developed a mathematical model suggesting that managing riparian forests for height was the most important management tool to influence direct solar radiation as diffuse radiation has no capacity to directly affect stream temperature. Therefore, DNR’s proposed restoration activities involving thinning in riparian stands, which will retain the largest trees and residual densities generally greater than RD 35 outside a 25-foot inner zone will maintain shade and microclimates not significantly different from unthinned stands.



Thinning intensity and pattern need to be moderated by considering the risks of windthrow.

Riparian stands undergoing hardwood conversion, which involves the removal of hardwood species outside the inner zone while maintaining all conifers, is likely to continue to provide many riparian functions including stream bank stability, leaf and needle litter recruitment and sediment control. Other functions may be significantly impacted such as stream shading and microclimate. Temperature, critical to fish habitat, is influenced by many variables. “Average daily stream temperatures are regulated by many factors: ambient air temperature, relative humidity, groundwater influx, stream channel morphology (including discharge rate), and substrate composition (Adams and Sullivan 1989, Brown 1969, Byram and Jemison 1943, NCASI 2000, Patton 1974). Solar radiation has a relatively small impact on daily mean stream temperatures (Adams and Sullivan 1989). However, solar radiation is most responsible for deviations from average daily temperatures (Adams and Sullivan 1989, Ice 2001), and is almost the only factor that can be controlled by (active or passive) forest management” (RTI 2002).

The effectiveness of the inner zone buffer in providing stream shading will depend mainly on stream orientation and width, buffer location and height of the buffer. Conversions located on the north side of streams will have a minimal impact on stream shading as will conversions along small streams. Newton and Cole (1998) reported that “streams buffered only on the south side with 40’ screens of shrubs and trees did not change temperature patterns from pre-logging conditions despite logging along half-mile reaches to the water’s edge on the north sides” for seven low-elevation Westside streams in Oregon. Therefore, conversions will require a case-by-case analysis of the potential impacts to riparian functions, in particular stream shading. To mitigate potential significant negative impacts, the inner zone may be expanded beyond 25 feet or additional hardwood trees may be retained outside the 25-foot inner zone. Emmingham et al. (2000) recommend residual red alder spacing of not less than 30 feet and gaps no smaller than ½ acre to establish conifers without any additional, future release treatments.

Hardwood conversions will generally balance negative short-term impacts to riparian functions such as stream shading and changes in microclimate with long-term enhanced functionality of pool-forming, long-lasting LWD, enhanced shade and stream bank stability.

For all management scenarios, the 25-foot inner zone will be expanded on a site-specific basis as necessary to protect riparian associated wetlands and to maintain post-treatment

shading of streams and other functions such as root strength of leave trees. The most common situation will be one of low tree density within the riparian inner zone. Because of low tree density, some of the function that would normally be provided within 25 feet may have to come from beyond the 25-foot zone.

Site-Specific Management

All management within Riparian Management Zones must be site-specific, i.e., tailored to the physical and biological conditions at a particular site. Management activities in RMZs must maintain or restore the quality of salmonid and riparian obligate species habitats; but due to variation in site conditions, the intensity of management and site response is expected to vary. As in the case of upland thinning prescriptions, existing stand conditions and site characteristics such as plant association or plant association group will be used to tailor specific prescriptions and provide an ecological context for documenting treatment response. Restoration in riparian areas along stream reaches with temperature-sensitive fish species will provide adequate post-treatment shade for protecting water temperature. Site-specific management will necessarily protect important features and, in many situations, result in management of only part of the entire RMZ.

In addition, tribal staff, Department of Fish and Wildlife biologists, and Department of Ecology staff will have local habitat and species information that could be useful for developing site-specific riparian prescriptions. DNR field managers are encouraged to contact other agencies and Tribes for additional site-specific information.

Monitoring Riparian Restoration

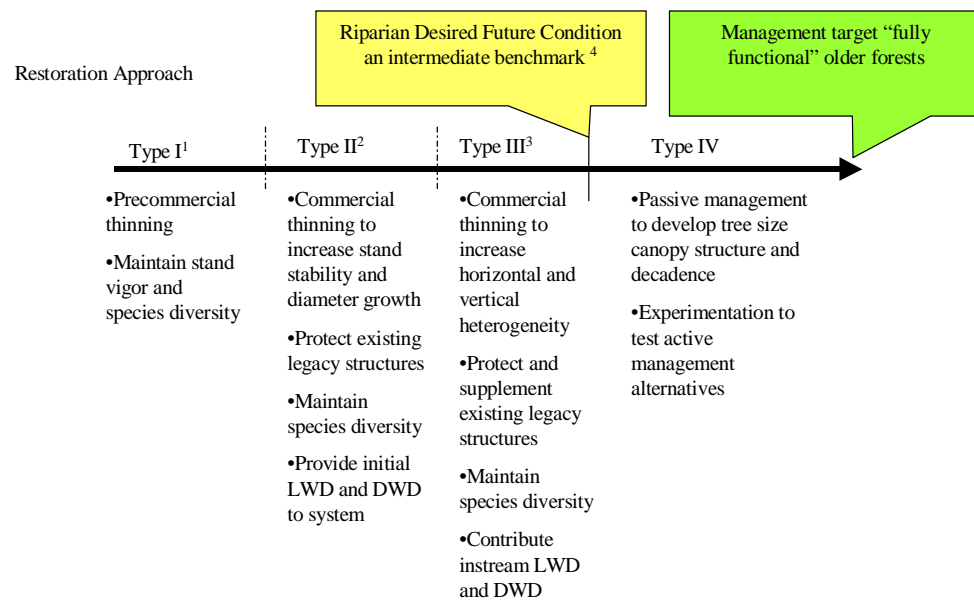
The trust lands HCP requires DNR to evaluate how well the riparian conservation objectives are met by the site-specific implementation of the riparian strategies (DNR 1997 V.1). Upon approval, this and other HCP strategies will be subject to compliance monitoring. DNR intends to apply commercial silvicultural treatments to a maximum of 1 percent of its riparian areas annually for the Westside planning units outside the OESF. Detailed riparian effectiveness monitoring plans have been drafted and will be reviewed by the Federal Services (Pollock et al. 2001, Wilhere and Bigley 2001a, 2001b). Scientifically valid monitoring of these activities will require controls and randomized sampling. Forestry activities will be randomly selected for monitoring, and a portion of the riparian buffer will be randomly selected to serve as an untreated control area. In 2009, DNR will provide a detailed implementation report to the Services on the status of the Riparian Forest Restoration Strategy. Section 4 provides a summary of the monitoring strategies and tactics.

Silvicultural Treatments

The long-term riparian habitat restoration goal is a structurally complex riparian forest, known as the Fully Functional forest development stage. Since this condition may evolve over centuries, DNR management is directed toward attainable intermediate objectives represented by the riparian desired future conditions threshold targets (Table 2). The main objective of silvicultural activities will be to put the RMZ on an accelerated trajectory toward the riparian desired future conditions. Figure 4 summarizes how different silvicultural treatments will move stands from the Sapling Exclusion Stage to the RDFC and

how passive management (Type IV stage) will then eventually lead to the long-term goal of Fully Functional forests. Management activities are classified by the stand development stages they will be taking place in: Type I treatments will be in non-commercial stands in the Sapling Exclusion Stage, Type II treatments in the Pole Exclusion Stage and Type III treatments in the Large Tree Exclusion or Understory Reinitiation Stage. Silvicultural treatments will be site-specifically designed to accelerate attainment of the desired stand condition and composition, and incorporate an assessment of risk. Silvicultural tools will include individual tree selection, thinning, group selection (small canopy gaps), down woody debris and snag creation, and patch cuts in hardwood-dominated stands. Prescriptions will take into consideration minimizing short-term impacts to riparian functions to achieve long-term, enhanced functionality. Management of riparian stands will only take place if management activities, within acceptable risk parameters, would decrease the time required to meet stand-specific riparian objectives in comparison to the no treatment option. Silviculturists will train field staff and/or conduct analyses for them.

When conducting riparian restoration activities, attention must be given to the promotion of spatial variability and species diversity within the riparian area. The goal is to attain a stand condition that contains vertical and horizontal heterogeneity and structural complexity similar to the stand conditions found in the Niche Diversification and Fully Functional stand development stages. It is recommended that the application of variable density thinning techniques be applied to the riparian area to promote heterogeneity in understory development, tree spatial and species variability, as well as maintain special landscape attributes (snags, wet areas, down woody debris).



¹ Stands with no or little existing structure in Sapling exclusion

² Stands with little existing structure in Pole exclusion

³ Stands with some existing structure in Large tree exclusion and Understory Reinitiation

⁴ Commercial thinning will cease before reaching the RDFC as restoration treatments have to accelerate the development towards the RDFC targets.

Figure 4. Illustration of DNR's Riparian Forest Restoration Strategy with different silvicultural treatments (Type I, II and III) to reach the riparian desired future condition, and passive management (Type IV) to reach the long-term objective of the Fully Functional forest development stage.

Pre-commercial Silviculture Treatments

The selection of site-adapted species is paramount in meeting the restoration objectives.

It is expected that most riparian management entries will be conducted coincident with adjacent upland management entries, such as pre-commercial thinning, commercial thinning, individual tree selection, group selection, patch cutting, or final harvest. On a given site, conducting silvicultural activities in riparian stands coincident with adjacent upland activities will offer new management opportunities. It is anticipated that most riparian stands can be significantly advanced toward the riparian desired future condition with only one or two management entries. Should a stand require more than two commercial management entries within the 70-year HCP planning period, consultation with appropriate specialists and prior approval by the HCP Implementation Management and consultation with the Federal Services will be required. Silvicultural prescription guidelines are grouped into pre-commercial treatments and commercial prescription categories by forest type (conifer and hardwood).

Riparian stands may require silvicultural treatments at a relatively young age. In fact, the first few years (Ecosystem Initiation Stage) might be the most important development phase toward meeting the riparian desired future conditions. DNR will need to consider:

- Adequate forest stocking through planting density,
- Site preparation,
- Species composition,
- Vegetation management (controlling competing vegetation), and
- Pre-commercial thinning (Type I thinning).

The selection of site-adapted species is paramount in meeting the restoration objectives. Type I thinning activities may take place inside the inner zone to the edge of the 100-year flood plain. Other non-commercial activities, such as underplanting, noxious weed control or supplementing of down woody debris or large woody debris instream may also take place in the inner zone.

Commercial Silvicultural Treatments

In general, commercial silvicultural treatments will take place in the riparian zones with trees in competitive exclusion stages of development. To facilitate development of silvicultural prescriptions for commercial treatments, DNR has identified two broad conditions under which riparian stands would be entered (discussed above). This would result in a total of five general management scenarios (Table 4, and Appendix 5). These five management scenarios were chosen because they represent the best opportunities for riparian forest enhancement activities compatible with other DNR upland management activities. This synchronized approach ensures that upland areas are not disturbed on multiple occasions.

Conifer stand prescriptions are delineated according to structural development stage, because objectives likely differ between the Pole Exclusion Stage and later stages (Large Tree Exclusion, Understory Reinitiation) of stand development. Silvicultural treatments in the Pole Exclusion Stage will primarily focus on accelerating diameter growth and maintaining species diversity and are referred to as Type II thinnings. Type II thinnings generally occur in stands below 40 years in age and represent plantations established after

regeneration harvest. Treatments in the later structural development stages, which will focus mainly on creating horizontal and vertical heterogeneity and structure, are referred to as Type III thinnings.

The Technical Review Committee has had extensive discussions regarding the use of stand age to determine an upper threshold when Type III thinnings would not be appropriate. The use of stand age to determine this threshold can be difficult to estimate and can be a deceiving measure for describing the conditions of a forest stand. While age class is useful for describing the conditions of an even-aged forest managed for timber production, it is not considered useful for describing the ecological conditions of a forest when managing for structural and biological diversity. However, to take a conservative approach when applying these Riparian Forest Restoration Strategies, the Technical Review Committee recommended Type III thinnings only occur in stands less than 70 years of age. If appropriate, thinning activities may occur in stands greater than 70 years of age with written approval from the HCP Implementation Manager and in consultation with the Federal Services. This approach to thinning older stands will be reviewed by the Technical Review Committee at the end of the three-year implementation period.

Each scenario contains certain levels of risks and opportunities, which will be outlined in the silvicultural prescription specific to each site and scenario. A given management scenario must be compared to the no treatment option to determine if progress toward the riparian desired future conditions will be made.

Table 4. Riparian management scenarios

Conifer Dominated Stands (Conifer Basal Area >50%)	Hardwood Dominated Stands (Conifer Basal Area <50%)
<ul style="list-style-type: none"> No commercial treatments required – Riparian Stand on Pathway to RDFC 	<ul style="list-style-type: none"> No commercial treatments required – Riparian Stand on Pathway to desired future conditions
<ul style="list-style-type: none"> Type II (little existing structure) RMZ Thinning with Upland Thinning 	<ul style="list-style-type: none"> Individual Conifer Release
<ul style="list-style-type: none"> Type III (some existing structure) RMZ Thinning with Upland Thinning 	<ul style="list-style-type: none"> Conversion to Conifer Dominated Forest
<ul style="list-style-type: none"> Type III RMZ Thinning with Upland Regeneration 	

Disturbance of the inner 25-foot zone will be restricted to road crossings and yarding access, as specified in the operations guidance. Other activities, such as underplanting of shade tolerant conifers, noxious weed control, release of suppressed understory conifers or supplementation of down woody debris or large woody debris in or across streams may also take place in the inner zone. Restoration of in-channel salmonid habitat may take place in coordination with the DNR HCP Implementation Manager, and with written approval from the appropriate regulatory authority.

Site considerations influencing potential impacts to stream temperature, sediment delivery, and water temperature will be carefully evaluated. This will include contributing wetlands, groundwater inputs, east-west orientation, and elevation. Before conducting commercial silvicultural treatments in RMZs, a biologist or riparian strategy region designee should be consulted to assess potential impacts to riparian functions.

Specific Silvicultural Prescriptions

DNR's riparian restoration activities will focus on: 1) growing large conifer trees; 2) enhancing structural complexity; 3) attaining a site-adapted species composition dominated by conifers; 4) providing DWD and instream LWD; and 5) creating snags. Therefore, silvicultural activities will primarily consist of thinnings and down woody debris enhancements in conifer-dominated stands, and patch cuts (followed by planting of conifers) in hardwood-dominated stands. Experience from upland thinnings and riparian treatments in the OESF indicate that a moderate intensity of thinning, i.e., to residual RD levels of 35 to 40, will move riparian restoration toward interim conditions faster than light thinning, i.e., RD >40, and provide ecological benefits for approximately 15 to 20 years, depending on site class.

Instream structural legacy trees often control stream fluvial processes and habitat structure.

Nevertheless, even with moderate thinning, some riparian stands may re-enter the competitive exclusion stages within one or two decades after treatment before they reach the riparian desired future condition. Where appropriate, small gaps may be used in conifer-dominated stands to hasten the development of a more complex vertical stand structure. Gaps are an uneven-aged management method to create structural heterogeneity and should be, in general, 0.25 acres in size or less. Gaps shall only be used outside the 100-foot zone from the 100-year flood plain. Patch cuts, in contrast, are an even-aged regeneration method and will only be used in the hardwood conversion scenario. Patch cuts will not exceed 2.5 acres and will be outside the inner riparian zone.



As previously stated, when conducting riparian restoration activities, attention must be given to the promotion of spatial variability and species diversity within the riparian area. The goal is to attain a stand condition that contains vertical and horizontal heterogeneity and structural complexity similar to the stand conditions found in the Niche Diversification and Fully Functional stand development stages. It is recommended that the application of variable density thinning techniques be applied to the riparian area to promote heterogeneity in understory development, tree spatial and species variability, as well as maintain special landscape attributes (snags, wet areas, down woody debris).

Commercial silvicultural treatments will remove merchantable trees after down wood targets are met. In the conifer prescription category (conifer basal area > 50 percent), the following pre-harvest conditions shall exist before considering an enhancement activity:

- Live crown ratios of residual trees are > 35 percent
- Height-to-diameter ratios of residual trees are < 90

Table 5 provides a general summary of activity prescriptions by stand composition and age. These numbers represent minimum management parameters not to be exceeded and do not represent management threshold targets. Management threshold targets are presented in Table 2.

Table 5. Minimum management parameters for prescriptions from the HCP Riparian Forest Restoration Strategies

Buffer Area	Coniferous Dominated	Deciduous Dominated
Inner Zone	No timber removal. Restoration limited to wood placement, underplanting, release of suppressed conifers, LWD creation and noxious weed control	
Middle Zone	<ul style="list-style-type: none"> ▪ $RD^a > 35$ (RD 30 with HCP Implementation Manager¹ approval) or at least 100 (75 in Type III thinnings) dominant and co-dominant tpa^b, whichever results in the greater number of residual trees ▪ $d/D - \text{ratio} \leq 1.0^c$ ▪ Maintenance of species diversity (including hardwoods) ▪ Designate 5 conifer trees per thinned RMZ acre from the largest diameter class(es) of the thinned trees for riparian habitat enhancement. In Type II thinnings (i.e., ≤ 40 years) fall all 5 trees to be left as DWD and LWD. In Type III thinnings consider topping 1 to 2 of the 5 designated trees above 20' or girdling for snag creation if stand is snag deficient. The trees to be felled shall be chosen from within 25 feet of the riparian forest management unit (FMU) boundary adjacent to the inner zone; and shall be felled toward the stream where feasible. 	≥ 25 conifer tpa: Conifer Release < 25 conifer tpa: Conversion
Outer Zone	Same as Middle Zone	Same as Middle zone
Wind Buffer	Same as Outer Zone	Same as Outer zone

^a RD means relative density. $RD = (\text{basal area})/\sqrt{(\text{quadratic mean diameter})}$. RD based on trees $> 6"$ DBH

^b tpa means tree per acre. It is simply the tree stem density $> 6"$ DBH

^c d/D-ratio means d is the average DBH of trees removed in thinning and D is the average before thinning. Used to characterize methods of thinning quantitatively: $d/D = 1.0$ means a proportional thinning, $d/D > 1$ means a thinning from above, $d/D < 1$ means a thinning from below.

Conifer-Dominated Riparian Scenarios

1. TYPE II RMZ THINNING IN CONJUNCTION WITH UPLAND THINNING

Description

Type II thinnings are defined as treatments taking place in stands that have more than 50 percent conifer basal area and are in the Pole Exclusion stand development stage. Generally, stand age is 40 years or less and the QMD (for trees $> 3.5"$ DBH) averages 10 inches (DNR 2004 page B-34). Relative density is generally greater than 45. This age also coincides closely with the start of intensive plantation forestry and should contain exclusively planted second- or third-growth stands with little or no vertical and horizontal structure.

Activity Objective

The objective for these young, homogeneous stands is to accelerate individual tree growth, vigor, and stability. The goal also is to promote tree species diversity while

providing for short- and long-term riparian functions. In particular, where available, site-adapted species such as western red cedar and other shade tolerant trees will be retained as a component for further vertical canopy development. These trees will be important contributors to future stand structure. Snags that have a high likelihood of long-term function or that are rare on the landscape will be protected.

Activity Prescription Process

Activity objectives for the riparian and upland stands are usually compatible.

Prescriptions will be based on site characteristics (including plant association groups) and existing stand characteristics. Verification will take place to ensure that site and stand

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characteristics for upland and riparian management areas are similar enough to warrant similar management. It is anticipated that similar, but modified prescriptions from the uplands will be applied to the middle and outer zones of the Riparian Management Zone. Some modifications may include the creation of small gaps, protecting some hardwoods—in particular big-leaf maple—or favoring certain tree species, such as western red cedar, and protecting Type 5 streams and riparian associated wetlands.

These stands typically produce competition-induced, small-sized down woody debris that decomposes within a decade and provides few ecological benefits. However, the down wood may be used as large woody debris in or across the water. Even small diameter down wood (<20 cm) can be functional in small streams (Beechie and Sibley 1997 in Lassettre and Harris 2001). Entering the riparian zone for restoration harvest provides an opportunity to contribute down wood from a larger size class to the riparian habitat that will be functional until the next entry or until larger down wood becomes available naturally.

Management Parameters

The following minimum management parameters shall be met post-treatment:

- Relative density >35 (RD 30 with HCP Implementation Manager approval), or at least 100 dominant and co-dominant trees per acre, whichever results in the greater number of residual trees
- d/D ratio ≤ 1.0 (d = mean diameter of cut trees; D = mean stand DBH before thinning)
- Maintenance of species diversity, including hardwoods

Designate five (5) conifer trees per thinned RMZ acre (outer and middle zones) from the largest diameter class of thinned trees to be felled and left as down woody debris. These trees are in addition to the minimum of 100 dominant and co-dominant (live) residual trees (> 6" DBH) required per acre. The trees to be felled shall be chosen from within 25 feet of the riparian forest management unit (FMU) boundary adjacent to the inner zone; and shall be felled toward the stream where feasible.

Evaluation

When the opportunity arises, this prescription will have the highest priority of all riparian restoration efforts. The benefits of thinning in stands in the Stem Exclusion Stage have been well documented (RTI 2003, Poulin et al. 2000). These stands generally provide excellent opportunities for riparian habitat enhancement, including the maintenance of high quality snags when they occur. Younger stands in particular are dynamic and tend to respond quickly to treatments. In addition, there is low risk of thinning-induced loss in the 5- to 10-year recovery period following thinning in these stands.

2. TYPE III RMZ THINNING IN CONJUNCTION WITH UPLAND THINNING

Description

Type III thinnings are defined as treatments in stands that have more than 50 percent conifer basal area and are in the Large Tree Exclusion development stage, or a later stage. Generally, stand age is greater than 40 years and the all-tree QMD (for trees > 3.5" DBH) is greater than 10 inches (DNR 2004 p. B-34). Type III thinnings will occur in stands less than 70 years of age. If appropriate, thinning activities may occur in stands greater than 70 years of age with written approval from the HCP Implementation Manager and in consultation with the Federal Services. This approach to thinning stands will be reviewed by the Technical Review Committee at the end of the three-year implementation period. For more information, see Implementation Period Commitments (page 46). Adjacent upland stands at this stage will be managed with a range of silvicultural tools including thinnings, partial cuts, and selective tree removals for a variety of objectives to:

- Provide habitat for certain species, such as the northern spotted owl,
- Lengthen rotation ages,
- Even out age class distributions in a landscape,
- Protect unstable areas,
- Or meet hydrological maturity goals.

Depending on their age, origin and development, these stands may contain more structural complexity than young plantations but still be lacking multiple canopies, and deficient in large live, deformed trees, and large down wood and snags.

Activity Objective

The objectives in these stands with low to moderate levels of structural complexity will be to accelerate individual tree diameter growth, maintain vigor and stability, promote tree species diversity, protect existing structural components, and enhance structural diversity while providing for short- and long-term riparian functions. In particular, snags, down wood, remnant trees, and advance regeneration will be protected as much as possible. A component of shade-tolerant tree species such as western red cedar, Sitka spruce and western hemlock, and some hardwoods (big-leaf maple) will be retained. Growing large, vigorous trees in the outer zone of the RMZ will be integral to minimizing risk of windthrow when the adjacent upland stand is regenerated in the future.

Activity Prescription Process

Activity objectives for the riparian and upland forest are likely to be pursued simultaneously. Prescriptions will be based on site characteristics (including plant association groups) and existing stand characteristics. Verification will take place to ensure that site and stand characteristics for upland and riparian management areas are similar enough to warrant similar management. In general, DNR anticipates applying similar—but modified—prescriptions to upland stands and middle and outer Riparian Management Zones.

DNR's goal in this riparian prescription is to safeguard the existing structures and components contributing to stand complexity. Thinning and group selection also is an opportunity to enhance or create a mosaic of thinned areas, "skips" (unthinned patches) and gaps, depending on existing stand structure. Skips will be placed around structures such as snags, existing accumulations of down wood, Type 5 streams, riparian wetlands,

and advanced regeneration. Small gaps (0.25 acre or less and more than 100' from the 100-year floodplain) could be created by removing red alder or diseased conifers, or may be used to enhance existing advanced regeneration. Some hardwoods and shade-tolerant, site-adapted species, such as western red cedar, will be retained. Prescriptions in this scenario will resemble variable density prescriptions applied in Dispersal and Nesting, Roosting, and Foraging Management Areas.

In order to move the stand toward the desired riparian forest condition target, dead down wood will be created to supplement natural mortality or down wood from an earlier harvest. Where feasible, DNR is to consider the creation of two snags per acre.

Management Parameters

The following minimum management parameters shall be met post-treatment:

- Relative density >35 (RD 30 with HCP Implementation Manager approval), or at least 75 dominant and co-dominant trees per acre, whichever results in the greater number of residual trees
- d/D – ratio ≤ 1.0 (d = mean diameter of cut trees; D = mean stand DBH before thinning)
- Maintenance of species diversity, including hardwoods
- A total of five (5) conifer trees per thinned RMZ acre (outer and middle zones) from the largest diameter class of the thinned trees shall be designated for riparian habitat enhancement. These five (5) trees are in addition to the minimum of 75 dominant and co-dominant live residual trees (>6" DBH) required per acre. Three to five of these trees shall be felled toward the stream to serve as instream large woody debris and down woody debris. The trees to be felled shall be chosen from within 25 feet of the riparian forest management unit (FMU) boundary adjacent to the inner zone; and shall be felled toward the stream where feasible. DNR will consider topping one or two of the designated trees at or above 20 feet in height or other suitable methods to create snags or cavities in live trees if stand is snag deficient.

Evaluation

When the opportunity arises, this prescription will have the second highest priority of all riparian prescriptions. Most stands will represent a low to moderate level of risk in terms of restoration success and provide opportunities for riparian habitat enhancement. The responsiveness of older stands to thinning has been previously demonstrated (Newton and Cole 1987). In general, windthrow risk is low due to upland forests protecting the riparian stand. However, thinning response and likelihood of windthrow will vary depending on species thinned, crown ratios, plant association group, and thinning intensity.

3. TYPE III RMZ THINNING IN CONJUNCTION WITH UPLAND REGENERATION HARVEST

Description

Type III thinnings are defined as treatments in stands that have more than 50 percent conifer basal area and are in the Large Tree Exclusion development stage, or a later stage. Generally, stand age is greater than 40 years and the all-tree QMD (for trees >3.5" DBH) is greater than 10 inches (DNR 2004 p B-34). Stands greater than 70 years of age are eligible for restoration, but require approval from the HCP Implementation Manager in consultation with the Federal Services. This approach to thinning older stands will be reviewed by the Technical Review Committee at the end of the three-year

implementation period. As described earlier, these stands will benefit from silvicultural treatments and the development of structural diversity can be accelerated. Depending on the timing of the regeneration activity, these stands will be similar to the stands described in the previous scenario. The major difference will be that the adjacent upland stand will be removed and the riparian forest will be exposed to the elements, especially wind.

Activity Objective

Objectives for activities in these young to intermediate-aged riparian stands with low to moderate levels of structural complexity will be the same as in the previous scenario. Older stands with high levels of structural complexity or snags might be on the way to the riparian desired future conditions and may be a lower priority for treatment or may not need any treatment.

Activity Prescription Process

The silvicultural objectives and prescriptions will be different for upland versus riparian forests. A natural resource specialist, such as a silviculturist or a biologist, should be consulted to help develop site-specific management. The prescription will contain similar structure-based thinning components as outlined in the previous scenario—to protect existing habitat components—and are subject to the same management parameters. Down woody debris will also be created at this opportunity to enhance riparian and instream habitat.

Management Parameters

The following minimum management parameters shall be met post-treatment:

- In areas of low windthrow risk: relative density >35 (RD 30 with riparian designee approval) of the dominant and co-dominant canopy, or at least 75 dominant and co-dominant trees per acre, whichever results in the greater number of residual trees.
- In areas of moderate and high windthrow risk: post-thinning relative density > 60 percent of the pre-thinning relative density of the dominant and co-dominant canopy, and relative density >40 or at least 75 dominant and co-dominant trees per acre, whichever results in the greater number of residual trees. Wind buffers (50' or 100') are part of the RMZ and shall receive the same treatment.
- d/D -ratio ≤ 1.0 (d = mean diameter of cut trees; D = mean stand DBH before thinning)
- Maintenance of species diversity (including hardwoods)
- A total of five (5) conifer trees per thinned RMZ acre (outer and middle zones) from the largest diameter class of the thinned trees shall be designated for riparian habitat enhancement. These five (5) trees are in addition to the minimum of 75 dominant and co-dominant live residual trees ($>6"$ DBH) required per acre. Three to five of these trees shall be felled toward the stream to serve as instream large woody debris and down woody debris. The trees to be felled shall be chosen from within 25 feet of the riparian forest management unit (FMU) boundary adjacent to the inner zone, and shall be felled toward the stream where feasible. Consider topping one or two of the designated trees at or above 20 feet in height or other suitable methods to create snags or cavities in live trees if the stand is snag-deficient.

Areas with a moderate windthrow risk are areas of wind exposure where the adjacent regeneration harvest could channel winds into the RMZ. Areas with a high risk of windthrow are areas with slopes exposed to the south/southwesterly winter storm winds (and east winds near the Columbia River), high-water table with restricted rooting or soil cohesion, and stands with high height-to-diameter ratios and/or low live crown ratios. See section on wind buffers for details on making site-specific assessments on windthrow risk.

Evaluation

Uncertainty about the potential success of a restoration effort is considerably higher than in the two previously described scenarios, relegating this activity to a medium priority (see Appendix 4). The uncertainty is due to the variables in the amount of windthrow that might occur by potentially exposing treated stands to higher wind speeds. These stands often have not been previously thinned, and consist of trees that have adapted their crown ratios and roots to stand conditions of competition mortality. Therefore, they are relatively unprepared for cutting edges and are vulnerable to windthrow. Topographic variables and species composition also are factors in determining windthrow risk (Steinblums et al. 1984).

Little experience exists in thinning riparian stands in conjunction with adjacent upland regeneration harvests. DNR anticipates that this scenario will be successful in accelerating riparian stand development on certain sites with appropriate silvicultural treatments. A conservative approach will allow DNR to monitor its success and develop guidelines for site selection and silvicultural techniques to achieve riparian objectives in this scenario. Over time, as riparian stands receive early density management treatments, the risk of windthrow will decrease with upland regeneration harvest activities.

Hardwood-Dominated Riparian Stands

4. INDIVIDUAL CONIFER RELEASE

Description

“In hardwood-dominated riparian areas with overtopped conifers, conifers that have nearly grown through the hardwood canopy can be released by gap creation or thinning” (Hayes et al. 1996). This scenario occurs in stands where many conifers were established but never achieved overstory status. Most were out-competed by hardwoods—especially red alder—and remain suppressed. Stands where shade tolerant conifers are slowly overtaking culminated hardwood stands may also have this stand structure. In order to achieve a conifer-dominated RDFC, at least 25 viable conifers per acre should be present with reasonable chance of release.

The objective will be achieved by selectively removing hardwood trees overtopping or otherwise competing with conifer trees for resources (i.e., space, light).

Activity Objective

The objective for activities will be, by altering the stand composition, to create a horizontally and vertically more diverse stand that will be dominated by present or future conifers. The objective will be achieved by selectively removing hardwood trees overtopping or otherwise competing with conifer trees for resources (i.e., space, light). The Forest Management Unit objective includes release of conifers from the hardwood competition in order to accelerate their height, crown, and diameter development. As a result, the treatment will provide large, live trees, horizontal and vertical diversity, snags and down wood for the riparian ecosystem. Any existing structures such as snags and down woody debris will be protected.

Activity Prescription Process

This activity may take place in conjunction with upland thinning or regeneration harvest. The upland and riparian objectives and prescriptions are likely to be mutually achievable if riparian stand data is gathered to determine if a sufficient number of viable conifers (>25 per acre) are present. The prescription will either target individually marked trees for removal to release the selected conifers, or contain a certain cutting radius around each conifer. No conifers will be cut except for yarding corridors or skid trails. Hardwoods that are not competing with conifers will be left, except for yarding corridors or skid trails. A natural resource specialist, such as a silviculturist or a biologist, should be consulted to help develop site-specific management.

Viable conifers have the following characteristics:

- DBH >6"
- Live crown >30 percent
- Height to diameter ratio <100
- Free of root rot

These characteristics reflect minimum thresholds of “marginal” trees to be released as described by Emmingham et al. (2000). Higher live crown ratios and lower height to diameter ratios indicate more vigorous trees with greater potential for successful release.

Evaluation

Success with the release of suppressed conifers in riparian areas through patch cutting and thinning has been demonstrated in Oregon (Emmingham and Maas 1994, Emmingham et al. 2000). Previously overtopped conifers are more susceptible to thinning shock, and also may have heightened vulnerability to windthrow and ice damage. However, the risk of restoration failure in these types of stands is variable and condition specific. It is not anticipated that this will be a common riparian restoration activity. Due to a lack of experience, DNR will take a conservative approach and monitor success in order to refine silvicultural approaches as necessary.

5. CONVERSION OF HARDWOOD TO CONIFER-DOMINATED RIPARIAN STANDS

Description

Hardwood stands to be considered for conversion are generally 30 to 80 years old and may contain less than 25 viable conifers per acre. They contain a rich herbaceous and shrub understory and may contain some advance regeneration of conifers. Conversion may be a necessary tool in circumstances where it can be reasonably assumed that natural succession would lead to a shrub-dominated community. This process can also help accelerate the establishment of a structurally diverse, conifer-dominated stand.

Activity Objective

The objective for activities is to create a conifer-dominated stand that will develop into an older forest condition by eliminating the current hardwoods and establishing a mix of site-adapted conifer species.

Activity Prescription Process

This activity may take place in conjunction with upland thinning or regeneration. Pre-treatment survey data will be collected in the riparian zone to determine the number of

viable conifers per acre. If not enough viable conifers are present (<25 per acre), the following silvicultural prescription shall be followed:

- All hardwoods except 1-3 big-leaf maple per acre (if present) will be cut in patches. Each patch shall be 2.5 acres in size or smaller. Patch cuts shall be separated by uncut segments, which run for a minimum of 150 feet parallel to the stream. All live conifers must be retained in the patch cuts and advance conifer regeneration shall be protected where operationally feasible.
- Brush competition will be treated (manual cutting or chemical site preparation and/or release) and the number of site-adapted conifers required by a site-specific silvicultural prescription will be established. Vegetation management will continue until conifer trees are free to grow.
- Preferred tree species will be western red cedar, Douglas-fir, and Sitka spruce. It is anticipated that natural regeneration of hardwoods will occur and be a component of the future riparian stand.
- The size of the inner zone shall be expanded, where necessary to minimize the short-term impacts to riparian functions, especially shade, on a site-specific basis.
- A natural resource specialist (i.e., biologist, silviculturist) shall be consulted to help draft a site-specific management plan to ensure that the long-term restoration objectives will be met while minimizing the short-term impacts
- Hardwood stands shall not be converted if it is determined that:
 - The site is not conducive to conifer growth (i.e., based on physical criteria or the lack of conifer stumps).
 - The upstream/downstream forest landscape assessment reveals that the forest stand should be retained in the present condition in order to provide a mixture of conifer/hardwood conditions across the landscape. Restoration is deemed cost-prohibitive or impractical in light of the need for repeated brush control treatments.

Evaluation

Hayes et al. (1996) commented that “reshaping the landscape to increase the amount of conifer-dominated riparian areas may be a valid long-term goal, but this may have a number of currently unforeseen long-term consequences,” and a conservative approach should therefore be taken. Successful restoration of hardwood dominated stands to conifer stands may depend mostly on appropriate site selection, which is tied to a broader landscape perspective. Conversions are not appropriate on all sites, and some hardwood dominated riparian forests may be desirable.

Reforestation will be challenging, requiring close attention and above-average financial resources to control competing vegetation for several years. Successful restoration can only be accomplished through the application of sound silviculture to what promises to be a lengthy and costly restoration effort (Emmingham et al. 2000). The risk of restoration failure in these types of stands is moderate. Released conifers may be more susceptible to thinning shock, windthrow, and ice damage. Advance conifer regeneration, if present, may be damaged during logging.

Documentation of Silvicultural Activities

Documentation of silvicultural activities will follow the same guidelines developed for upland management activities. Riparian Management Zones will be delineated spatially as Forest Management Units (FMUs) in DNR's database. Planned riparian activities must be entered into DNR's Planning and Tracking (P&T) System for each riparian FMU. The entries must include all management activities until the stand reaches the final objective, the riparian desired future condition. Silvicultural prescriptions for individual riparian FMUs must include four essential elements to be recorded in P&T:

1. Current situation—describing the riparian stand condition relative to its objectives at the time the prescription is written.
2. FMU stand objectives—the long-term or ultimate management goals for the FMU, consisting of attributes described using action verbs, broken down into discrete and measurable threshold targets.
3. Threshold targets—representing the array of discrete and measurable components that constitute FMU objectives. For example, for the FMU objective “attain functional riparian forest conditions,” the threshold targets might be described in terms of tree species, number of dominant/co-dominant trees, relative density, and amount of down woody debris. Threshold targets are important to silvicultural prescriptions because their achievement can be modeled, predicted, and monitored.
4. Activity objectives—desired immediate outcomes of activities (e.g., “pre-commercially thin to 300 stems per acre”) undertaken to accelerate the attainment of FMU objectives.
5. Chronology of entries—describing in detail the current activity objective and riparian desired future condition.

Desired future condition provides a general vision of the state of riparian forests under the trust lands HCP (i.e., older forest condition). DNR has both a short-term and long-term concept of the desired future condition, which resembles the various stages of forest development and corresponding management intensities.

***Desired future condition
provides a general vision
of the state of riparian
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lands HCP (i.e., older
forest condition)***

Forest Management Unit (FMU) objectives, threshold targets, and activity objectives are goal-oriented concepts that underlie the silvicultural prescription process (Figure 5). This Riparian Forest Restoration Strategy is fully supported by DNR's existing procedures for the documentation for silvicultural activities.

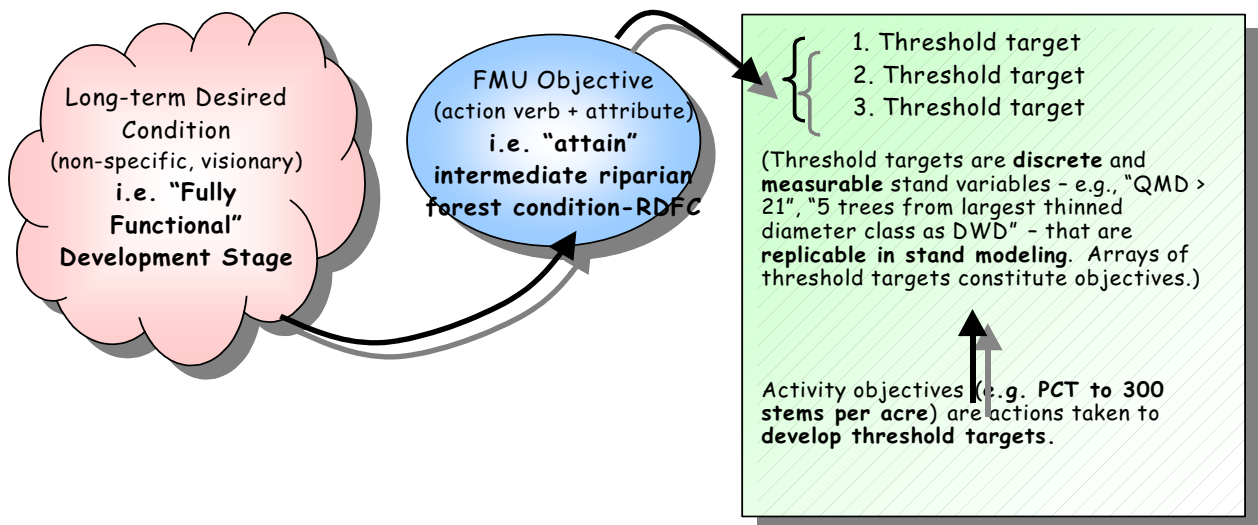


Figure 5. Relationship between the elements of various types of objectives.

Operational Guidance for Riparian Silvicultural Activities

This section clarifies allowable activities within Riparian Management Zones—in addition to the timber harvesting addressed previously—and expands on the discussion within the trust lands HCP (DNR 1997 IV. 73).

Roads

Roads for forest management and other activities will continue to be used and constructed within Riparian Management Zones. However, within riparian areas and on a case-by-case basis DNR intends to continue removing roads that are no longer necessary and that may be adversely affecting riparian function. The HCP provides some road guidance in the Road Network Management section (DNR 1997, IV 62). Any new road construction through RMZs should be minimized, and alternatives, including yarding systems, should be considered. When a road is constructed or reconstructed, the width of the right-of-way shall be minimized and if possible, the road should cross the stream at a right angle in order to minimize the amount of RMZ affected. Trees felled within the RMZ inner zone of Type 2-3 streams (25 feet on either side of the stream) for road construction, reconstruction or maintenance will be used for instream riparian enhancement, unless a biologist or engineer determines the site is unsuitable for wood placement. Placement of large woody debris in Type 1 streams should be done in consultation with the appropriate engineer and fisheries biologist.

- At each stream crossing, one (1) log from the largest cut conifer diameter class—in length at least two times the width of the ordinary high-water mark of the

stream—shall be placed across the stream on the down-stream side of the crossing.

- Three (3) root wads, if present, shall be placed additionally in or along the stream channel on the down-stream side of the crossing.
- All other grubbed stumps, when available, from within the inner zone shall be placed in a linear fashion at least 50' from the road in the middle or outer zone of the RMZ.
- All other timber within the right-of-way inside the RMZ may be removed.
- If instream habitat enhancement is not feasible, an alternate plan shall be forwarded to the appropriate HCP Implementation Management. A decision will be made and documented within 14 days.

Cable Yarding

Cable yarding through the riparian zone is allowed if it can be demonstrated that, by doing so, haul road densities are reduced for individual sales or for the landscape, or when cable yarding will result in less risk of sediment delivery to the stream. When using cable systems:

- Yarding corridors shall be minimized, in quantities and in width.
- Full suspension shall be required in the inner zone of the RMZ.
- Yarding corridors should be on average 12 feet in width or less (10 feet where possible).
- Yarding corridors should be on average at least 100 feet apart (120 feet where possible).
- Yarding corridors should be located in natural voids, where possible, while avoiding wetlands and concentrations of snags.
- Trees that are damaged during these operations in the middle and outer zone of the RMZ will be allowed to remain on site as live trees, snags, or down woody debris, and can be counted toward the riparian enhancement targets.
- Trees that are cut or damaged in the inner zone of the RMZ shall remain on site and cannot be counted toward the riparian enhancement targets.

Pole Sales in Riparian Management Zones

Expanding pole sales that are taking place adjacent to RMZs to include part of the outer and middle zone is permissible as long as selective pole tree removal is consistent with restoration objectives for the stand. If the harvest removes an average of 15 trees per acre or less, designate and fall one (1) tree per acre from the largest removed DBH class as down woody debris to be left on site. If more than 15 trees per acre are removed, designate 5 trees per acre to be left as down woody debris in the riparian zone or large woody debris in or across the stream.

Mobile Yarding

Low ground pressure mobile equipment will be allowed for thinning. Terrain and timing restrictions will be imposed to minimize impacts to the RMZ. Skid trails shall be kept to

a minimum, in both quantity and width. Skid trails should be at least 100 feet apart and, where possible, less than 12 feet in width. With the exception for road construction, no ground equipment will be allowed within 25 feet of the inner zone (leaving a 50-foot buffer of undisturbed ground vegetation along the stream). When feasible, the trees that are to be removed will be directionally felled away from the inner riparian zone. On slopes greater than 10 percent, skid trails located within 100 feet of the inner zone should not be perpendicular to the stream; the skid trails should be at a 45-degree angle or less (parallel if possible). Where possible, to reduce soil compaction and rutting, ground-based equipment shall walk on a mat of logging slash. Skid trails within the RMZ are to be water barred.

Salvage

Catastrophic windthrow can occur within the RMZ where a majority or all of the trees in the zone may blow down. While windthrow provides down woody debris to the riparian landscape and large woody debris to streams, it can be a detriment to the goal of maintaining other riparian forest functions. Windthrow may result in a dense stand composed of less desirable tree species arising from natural regeneration. Such a stand would be susceptible to future windthrow or to a return to a shrub-dominated community.

This blowdown occurs in many forms and sizes. When it occurs and salvage operations are being designed, a site-specific restoration plan will be required. The plan shall contain a strategy on how to meet the riparian desired future conditions including specific details about reforestation and down woody debris levels. The site-specific restoration plan shall be submitted to the HCP Implementation Manager for approval in consultation with the Federal Services. Upon submission, a decision on the merits of the restoration plan will be made within 60 calendar days. Otherwise DNR will carry out the plan as proposed.

Legacy Trees

The goal of green tree retention requirements for wildlife is to create patterns of leave trees in the upland area. Green tree retention requirements are in addition to trees left within RMZs. Riparian trees do not count toward the eight trees and/or snags per acre required by the HCP.



Wetland Management

Riparian associated wetlands (periodically inundated areas of Type 1, 2, and 3 Waters) will not be subject to thinning. Wetlands that are not associated with Type 1, 2, and 3 streams are managed according to existing HCP strategies.

Non-timber Resource Management

In addition to being managed for timber, the five Westside HCP planning units will continue to be managed for non-timber resources. Non-timber resources and activities include, but are not limited to, road use permits, sand and gravel sales, leasing for special forest products such as boughs and brush, prospecting leases and mining contracts, oil and gas leases, grazing permits and leases, communication site leases, recreation sites, utility easements and other special permits, licenses, sales, and leases. Non-timber activities will be managed in ways that support the HCP riparian strategy goals and objectives, as well as other relevant commitments of the HCP and DNR guidance such as the Policy for Sustainable Forests.

As described in the HCP (DNR 1997, IV. 191), non-timber activities are defined as “no take,” or insignificant (i.e., *de minimis*) at the levels of activities occurring January 1996. Starting on January 1, 1999, new or renewed permits, contracts, or leases for such activities include the commitments of the HCP, such that they will not increase the level of impact to the species covered by the HCP beyond a *de minimis* level. The determination of whether an activity will exceed *de minimis* levels is subjective and dependent upon the relative impact of the activity in relation to past activities. In general, the following guidelines should be applied to activities within Riparian Management Zones in order to remain below *de minimis* levels:

- Protect surface resources including soil and water.
- Protect the water from sediment delivery that might result from the activities.
- Minimize the amount and, therefore, the impact of non-restoration activities.
- Minimize the permanent loss of natural vegetation, function, and habitat.
- Avoid creating barriers to fish passage.

As stated previously in this document, the main group of riparian ecosystem benefits provided by Riparian Management Zones are: 1) stream bank stability, 2) nutrient load, 3) stream shading, 4) large woody debris recruitment, 5) sediment filtering, and 6) down woody debris on the riparian forest floor, and snags. All non-timber activities should strive to minimize the negative impacts to these riparian ecosystem benefits. If an activity must occur within an RMZ, consider mitigation measures to restore lost riparian function or benefits. Some mitigation opportunities are to:

- Replant exposed soils with native vegetation and trees,
- Place large or down woody debris in streams or in the riparian area,
- Create snags, and/or
- Add additional equivalent area to an RMZ.

Written exemptions will be requested from the Federal Services for the following activities within the required Riparian Management Zone along Type 1–4 streams: campgrounds, trail heads, surface disturbance activities from oil and gas leases or mining leases, rock and gravel pits, utility easements, and special forest product leases. If it is determined that any new instances of these activities must occur within an RMZ, the HCP Implementation Manager is to be contacted for consultation with the Services for approval. It may be necessary for other activities not listed above to occur within the RMZ. In those instances, condition the activity to meet the above guidelines and contact appropriate DNR Region or Land Management Division specialists for help in mitigation opportunities or assessment of *de minimis* levels.
